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Importance of structured training programs and good role models in hand hygiene in developing countries

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Summary The aim of this study is to identify the beliefs and perceptions associated with hand hygiene performance in two different institutions with limited resources and recently established infection control programme later than developed institutions. The study was conducted in two different hospitals (University Hospital—U-hospital and Community Hospital—C-hospital) in the same city by a self-administered questionnaire. Most questions were drawn from questionnaires used previously in other studies from ''industrialized'' countries based on ''The Theory of Planned Behavior''. All nurses, nurse students (last class), physicians and intern medical students in the U-hospital, and all nurses in the C-hospital were included into the study. Of 1764 questionnaires, 941 (41%) were returned. The return rate was highest for nurses in C-hospital (63.8% [303 of 475]) and lowest for senior physicians in U-hospital (7.5% [16 of 212]). Out of the respondent a total of 16 (1.7%) were senior physicians, 110 (11.6%) were physician assistants, 400 (42.6%) were nurses in the U-hospital, 303 (32%) were nurses in the C-hospital, 66 (7%) were medical students and 46 (4.9%) were nurse students. Seven hundred and ninety five (85.9%) of 926

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respondents were female. Respondents provided demographic information and data about various behavioral, normative, and control beliefs that determined their intentions with respect to performing hand hygiene. Among individuals from the other professional categories, a greater percentage of U-hospital nurses (57.6% vs. 53.9%, respectively) believed that healthcare-associated infections to be greater than 20%, and mortality rate among infected patients to be greater than 5%. C-hospital nurses generally believed the frequency, severity, and impact of healthcare-associated infections to be lower than U-hospital nurses and other individuals. However, all professional categories believed that good hand hygiene effectively prevents infections (98%). In univariate analysis, receipt of structured training in hand hygiene, perceived colleagues adherence's as good, adherence models good practices for others, having been observed for their adherence (normative beliefs), the perception that hand hygiene is relatively easy to perform and high workload (control beliefs) was associated with good hand hygiene. However, in multivariate analysis, high self reported adherence to hand hygiene was independently associated with receipt of structured training in hand hygiene, perceived good adherence by colleagues, the perception that hand hygiene is relatively easy to perform and having been observed for their adherence. In a country with limited resources, intention to comply was associated with training and strong normative and control beliefs. Also, in two different kinds of institution with the similar hand hygiene promotion campaign in the same city, the believes of nurses were different. In developing countries, more resources have to be allocated for training of HCWs and easy access for hand hygiene products.

Introduction

Hand hygiene is considered the cornerstone of infection control programs in hospitals. Despite evidence showing hand transmission of microorganisms during patient care activities, hand hygiene compliance is still low (<40%) [1—4]. To change hand hygiene behavior is a complex task and many factors influence this behavior. The most important negative factors are understaffing and overcrowding, lack of availability of hand hygiene products (soap, alcohol-based solutions, paper towels, etc.), lack of knowledge about hand hygiene, lack of institutional priority given to hand hygiene and lack of role models for good hand hygiene [2]. These problems are more evident in developing countries with limited resources, and the hand hygiene compliance of healthcare workers (HCWs) in these countries is usually lower than in developed countries [3—6]. In recent years, studies have focused on social cognitive models which can affect human behavior. *The Theory of Planned Behavior*, proposed by Icek Ajzen in 1985, is the most widely used model [7,8]. Using this theory, it is possible to measure the HCWs' intentions to adopt their behavior and to determine the possibility of behavioral changes. Pittet et al. [8—11] first studied the association of determinants of hand hygiene behavior and individual cognitive factors with actual hand hygiene adherence. These studies were performed in an industrialized country, and in an institution which had a long history of a ''well-organized'' infection control program.

In this study, we aimed to identify the beliefs and perceptions of HCWs associated with hand hygiene performance in two institutions in a country with limited resources, and a very recently established infection control program.

Methods

Setting

This study was carried out in two different hospitals. The first hospital is Erciyes University Hospital (U-hospital). It is a referral, tertiary hospital in the Central Anatolian region of Turkey with 1300 beds, contains 212 intensive care unit (ICU) beds. It is serving a population of approximately 5 million and having 65,000 admissions annually. In 2009, there were 3055 employees with 604 physicians (392 physician assistants, 212 senior physicians) and 685 nurses. An Infection Control Committee was established in 1997. In addition, a multimodal hand hygiene promotion campaign for all

HCWs (education programs, posters, distribution of alcohol-based products, etc.) was initiated in 2004. As a result of this campaign, the amount of alcohol-based handrub solution used in the hospital increased from 20 L per month in 2004 to 500 L per month in 2009. Hand washing facilities are located in each patient room and at nurse stations in the clinics. Three out of the four intensive care units are open-ward-units, with two to three sinks for nine beds. The forth, medical intensive care unit (24 beds), was recently built, and has one sink for every two beds. In addition, in all intensive care units and hematology—oncology clinics, alcohol-based solutions are located at patients' bedsides. In other patient clinic areas, alcohol-based solutions are only available in nurses' treatment rooms and dressing rooms. Pocket-sized bottles of alcohol-based solutions are not available in this institution. In the intensive care units, the 24-h nurse/patient ratio is approximately 0.5 or 0.7. The hospital infection rate was 10.8% in a one-day point-prevalence study in 2009, and the incidence density of healthcare-associated infections was 38/1000 patient days in adult intensive care units (Infection Control Committee surveillance report). Moreover, hand hygiene compliance among HCWs in intensive care units was 31% (Infection Control Committee record).

The other hospital in the study is a community hospital (C-hospital) in the same city, which was established as a research and training hospital in 2005. It has a 1100 bed capacity, with 15 ICU beds, and has 56,000 admissions annually. In 2009, there were 2600 employees, with 271 physicians and 475 nurses. An Infection Control Committee was established in 2004, and a multimodal hand hygiene promotion campaign, comparable to the one at U-hospital, was initiated in the same year. As a result of this campaign, the amount of alcohol-based handrub solution used in the hospital increased from 10 L per month in 2004 to 250 L per month in 2009. Hand washing facilities are limited to the clinics and in intensive care units (open-ward ICUs with one sink for every 7—9 beds). Alcohol-based solutions are available in ICUs, but not located at bedsides. In the clinics alcohol-based solutions are only available in nurses' treatment rooms and dressing rooms. Pocket-sized bottles of alcohol-based solutions are not available in this institution either. Furthermore, in intensive care units, the 24-h nurse/patient ratio is approximately 0.7. The incidence density of HAIs was 24.5/1000 patient days in adult intensive care units. The hand hygiene compliance rate of HCWs is unknown.

The patient characteristics of the two hospitals are very different. In U-hospital, advanced operations, diagnostic and treatment procedures are applied, and patients in this hospital's intensive care units have more severe diseases and more underlying diseases than those in C-hospital.

Study design

The study was conducted between June and October 2009 by means of a self-administered questionnaire. The questionnaire was adapted from the one used in the study of Sax et al. [9]. All nurses, nurse students (final year), physicians and intern medical students in the U-hospital and all nurses in the C-hospital were included in the study. The questionnaire was individually distributed to nurses, physician assistants and medical students and collected by members of the Infection Control Committee. Questionnaires for senior physicians were sent and collected by e-mail over a one-month period. It was sent by university server, so all the e-mails was received by physicians. In addition, nurse students' forms were distributed on an individual basis by the principle of the school. Hand hygiene is a term referring to any action of hand cleansing [2], and hospital acquired infections are infections acquired more than 48 h after admission [5].

Data analysis

Chi-square (χ^2) tests used of the Yates correction or the Fisher exact test were performed to determine significant differences in proportions among categorical variables. Univariate and multiple binary logistic regression was used to investigate the probability of adequate hand hygiene during 80% or more of hand hygiene opportunities. Multiple regression modeling was performed by the backward stepwise procedure. In the first step, all covariates were simultaneously taken in the regression model. Then from the set of covariates with $p \geq 0.05$ (or a block of covariates representing an underlying polytomous categorical variable), the one with the largest p-value was removed from the model, and the reduced model was re-estimated. This procedure was repeated until all of the covariates (or blocks of covariates) remaining in the reduced model had a p-value <0.05. Odds ratios (OR) and 95% confidence intervals (CI) were calculated using binary logistic regression for each model. Two-tailed p-values of <0.05 were considered to be significant. Statistical analyses were calculated by SPSS version 13.0 (Chicago, IL, USA).

Results

Out of 1764 questionnaires, 941 (41%) were returned. The demographic characteristics are shown in Table 1. Nurses in the C-hospital had the highest return rate (63.8% [303 out of 475]) while senior physicians in the U-hospital had the lowest (7.5% [16 of 212]). The majority of our respondents were young females. Ninety percent of respondents were below 40 years of age.

Table 2 shows HCWs' beliefs about the frequency, severity and impact of HAIs as well as their beliefs about the perceived effectiveness of hand hygiene, perceived social pressure and perceived self-efficacy. Of 871 respondents, 44% perceived the percentage of patients with HAIs to be greater than 20%; this belief was highest in U-nurses (57.4%) and lowest in C-nurses (28%). Of 839 respondents, 39.9% believed that the mortality rate due to HAI >5%, and 34.7% of 839 respondents believed that HAIs prolonged hospital stays >20 days. Conversely, C-hospital nurses' views on the severity of HAIs were not as strong as U-hospital nurses. Whereas, 98.4% of all professional categories believed that hand hygiene is very effective in the prevention of HAIs, a greater percentage of physicians believed that >70% of HAIs could be prevented by hand hygiene. A greater percentage of nurses judged hand hygiene to be a top safety priority for senior hospital management and nurse management. All professional categories perceived colleagues' adherence as good (79.7%). Medical students reported less social pressure from their superiors and colleagues. Furthermore, a greater percentage of both U-nurses and C-nurses perceived that role models served as good role models

Table 1 Demographic characteristics of respondents.

	n/no. of respondents[a]	%
Return rate of questionnaire forms[b]	941/2023	46.5
Senior physicians	16/212	7.5
Physician assistants	110/392	28
U-nurses[c]	400/685	58
C-nurses[d]	303/475	63.8
Nurse students	46/46	100[c]
Medical students	66/213	31
Variable, question item		
1. Profession ($n = 941$)		
Senior physicians	16	1.7
Physician assistants	110	11.7
U-nurses	400	42.6
C-nurses	303	32
Nurse students	46	4.9
Medical students	66	7
2. Female sex	852	90.5
3. Median age	30	Range, 20—59
4. Departmental distribution ($n = 876$)		
Internal medicine	156	17.8
Surgery	197	22.5
Pediatrics	144	16.4
Intensive care units	124	14.2
Outpatient clinics	58	6.6
Others	197	22.5
5. >10 years of experience since certification	343/794	43
6. >10 years of experience in that service	125/740	17
7. Participation in a previous hospital infection and hand hygiene education program	678/889	76
8. Have noticed being observed during hand hygiene practice	352/941	37
9. Being observed improved hand hygiene compliance	215/935	23
10. Hand rub for hand hygiene	151/941	16

[a] Denominators are varying because of difference in number of respondents to the questions.
[b] Nurse students' forms were distributed on an individual basis by the principle of the school.
[c] U-nurses: university nurses.
[d] C-nurses: community hospital nurses.

Table 2 Healthcare workers' beliefs about healthcare-associated infections (HAIs) and hand hygiene adherence according to professional category.[a]

Belief area, question number, item	No. (% of respondents)				
	Physicians (*n* = 126)	U-Nurses (*n* = 400)	C-Nurses (*n* = 303)	Nurse students (*n* = 46)	Medical students (*n* = 66)
Behavioral					
11: Percentage of patients with HAIs					
0—10%	27 (22.0)	52 (13.6)	111 (43.2)	3 (6.7)	14 (22.2)
11—20%	51 (41.5)	111 (29.0)	74 (28.8)	19 (42.2)	26 (41.3)
>20%	45 (36.6)	220 (57.4)	72 (28.0)	23 (51.1)	23 (36.5)
12: Mortality rate among infected patients					
0—2%	14 (11.5)	39 (10.5)	103 (43.1)	11 (25.0)	7 (10.9)
3—5%	44 (36.1)	132 (35.7)	100 (41.8)	20 (45.5)	34 (53.1)
>5%	64 (52.5)	199 (53.8)	36 (15.1)	13 (29.5)	23 (35.9)
13: Extra length of hospital stay for infected patients					
0—10 days	20 (16.4)	58 (15.2)	106 (40.3)	12 (26.1)	12 (18.5)
11—20 days	50 (41.0)	168 (44.1)	91 (34.6)	23 (50.0)	33 (50.8)
>20 days	52 (42.6)	155 (40.7)	66 (25.1)	11 (23.9)	20 (30.8)
14: Good hand hygiene effectively prevents infections	122 (98.4)	392 (98.7)	280 (97.9)	45 (97.8)	63 (98.4)
15: Percentage of infections prevented by good hand hygiene					
0—50%	13 (10.7)	92 (23.5)	132 (46.8)	8 (17.8)	21 (33.3)
51—70%	32 (26.2)	122 (31.2)	88 (31.2)	17 (37.8)	21 (33.3)
>70%	77 (63.1)	177 (45.3)	63 (22.0)	20 (44.4)	21 (33.3)
Normative					
16: Hand hygiene is a top priority for senior hospital management	70 (57.9)	293 (74.9)	225 (78.9)	30 (66.7)	28 (44.4)
17: Hand hygiene is a top priority for senior nurse management	71 (57.7)	317 (80.7)	225 (78.9)	30 (68.2)	33 (53.2)
18: Colleagues' adherence is good	102 (82.3)	301 (79.0)	262 (89.1)	37 (82.2)	44 (67.7)
19: Superiors expect adherence	102 (82.3)	374 (96.4)	264 (91.3)	41 (89.1)	44 (67.7)
20: Colleagues expect adherence	49 (39.5)	227 (57.6)	210 (73.2)	27 (41.3)	22 (33.8)
21: Adherence models good role models for others	108 (89.3)	367 (93.9)	264 (91)	39 (84.8)	50 (76.9)
Control					
22: Hand hygiene is relatively easy to perform	51 (41.8)	148 (37.8)	99 (34.5)	25 (54.3)	30 (46.2)
23a: Not believing effectiveness influence hand hygiene performance	2 (1.6)	13 (3.2)	12 (4.0)	4 (8.7)	2 (3.0)
23b: Overwork influences hand hygiene performance	97 (77.1)	309 (77.1)	190 (62.7)	38 (82.6)	54 (81.8)
23c: Difficulties in access to hand hygiene products influence hand hygiene performance	32 (25.6)	56 (14.0)	62 (20.5)	13 (28.3)	11 (16.7)
23d: Low-salary	0(0)	5 (1.2)	8 (2.6)	5 (10.9)	12 (18.2)
23e: Irritation of hand hygiene products influence hand hygiene performance	51 (40.8)	257 (64.1)	136 (44.9)	21 (45.7)	16 (24.2)

[a]Denominators are varying because of difference in number of respondents to the questions.

for others. All professional categories, with no significant differences, considered that hand hygiene was not easy to perform (61.3%).

The median overall self-reported rate of adherence to hand hygiene was 80% (range 0—100%). Physicians estimated their rate of adherence to be 70% (range 0—100%), U-nurses estimated theirs to be 80% (range 0—100%), C-nurses estimated theirs to be 80% (range 0—100%), nurse students estimated theirs to be 85% (range 0—100%) and medical students estimated theirs to be 69% (range 0—100%). There is no significant difference in declared good adherence rates (>80%) among the professional categories ($p = 0.09$).

The factors associated with a high self-reported adherence rate are shown in Table 3. In univariate analysis, factors associated with good hand hygiene were listed as: receiving structured training in hand hygiene, being observed for adherence (demographic characteristics), seeing colleagues adherence as a positive factor, understanding adherence models were good role models, expecting adherence by superiors (normative beliefs), believing that hand hygiene is relatively easy to perform, and having the perception that overwork influences hand hygiene compliance negatively (control beliefs). However, in multivariate analysis, high self reported adherence to hand hygiene was independently associated with receipt of structured training in hand hygiene, with adherence being perceived positively by colleagues, superiors expecting adherence and perceiving that hand hygiene is relatively easy to perform.

Independent explanatory factors for good hand hygiene for the three professional categories are shown in Table 4. The use of alcohol-based products was seen as an important predictor for good hand hygiene among U-nurses. U-nurses also viewed control beliefs (believing that hand hygiene is relatively easy to perform) as an independent predictor for good hand hygiene. Whereas training was a motivation for C-nurses and medical students. Superiors' expectation of adherence was important to physicians while C-nurses perceived that those adhering to good hand hygiene were good role models.

Discussion

In developing countries, the beliefs and perceptions of HCWs may be affected by ''negative'' conditions. This study was planned to investigate the behavioral considerations of different healthcare professions in a country with limited resources.

The vast majority of our respondents were female (85.9%), and younger (the median age was 30 and 89.5% of them were below 40 years of age) than reported in a previous study [9]. Also, the greater percentage of our respondents reported <10 years of experience both in their professions and in their length of service (57% vs. 83%, respectively). Astonishing is the lack of interest among the senior physicians with a response rate of 7.5%.

According to social cognitive models, human behavior is shaped by knowledge, motivation, intention, perception of threat, outcome expectancy, perceived behavioral control and social pressure [7]. In our study, most of the professional categories believed that high rates of HAI frequency and severity resulted in longer hospital stays for infected patients. Consequently, they had strong behavioral beliefs, as has also been noted in other studies [9—11]. On the other hand, behavioral beliefs were stronger in U-nurses than in C-nurses. These beliefs are probably affected by the difference in the characteristics of the patient population cared for in these institutions. In the university hospital, patients have more severe diseases, underlying diseases and invasive procedures. These factors affect the rates of HAIs, and also beliefs and viewpoint of HCWs about HAIs. On the other hand, all professional categories believed that good hand hygiene effectively prevents HAIs; 71% even believed that at least 50% of HAIs can be prevented by good hand hygiene. These strong behavioral beliefs are probably a result of training programs in our institutions since 2004, as 76% of HCWs reported receiving of training about hospital infection and hand hygiene. Insight into the epidemiology of nosocomial infections and stressing the importance of hand hygiene are the main aims of infection control training [7]. In our study the receipt of structured training is an independent explanatory factor for self-reported good hand hygiene. Especially, C-nurses and medical students, who involved in training program, reported 2 or 3-fold high self-reported good hand hygiene. This shows the importance of structured training programme in developing countries.

The other cognitive determinant of behavior is normative beliefs that defines the impact of social power on hand hygiene. The normative beliefs were stronger in our study than the previous studies [9—11]. The lowest rates of normative beliefs were in the group of medical students, who perceived less social pressure since they are not yet on duty. In the literature, role models and behavior of other HCWs significantly influences compliance rates of hand hygiene [12,13]. In our study 91% of our respondents believed that role models have

Table 3 Univariate and multiple (method: backward wald) binary logistic regression analysis for risk factors considered to be related with a high self-reported rate of hand hygiene (>80%).[a]

Variable, question item	No. (%) of respondents who reported good adherence	Univariate analysis			Multivariate analysis		
		Odds ratio	95% CI	*p*	Odds ratio	95% CI	*p*
Demographic characteristic							
2. Female sex	725/852 (85.1)	1.15	0.79—1.68	0.460	—	—	
3. Age > 40 years	59/673 (8.8)	1.12	0.65—1.19	0.684	—	—	
5. >10 years of experience since certification	323/726 (44.5)	0.93	0.69—1.24	0.612	—	—	
6. >10 years of experience at this department	140/656 (21.3)	1.02	0.70—1.48	0.923	—	—	
7. Receipt of structured training in hand hygiene	636/820 (77.6)	1.73	1.24—2.40	**0.001**	1.52	1.07—2.16	**0.02**
8. To be noticed having been observed	327/866 (37.8)	1.39	1.06—1.83	**0.019**	—	—	
10. Hand rub for hand hygiene	113/708 (15.6)	1.43	0.95—2.15	0.085	—	—	
Behavioral belief							
11. Percentage of patients with HAIs					—	—	
0—10%	196/819 (23.9)	1	0.69—0.99	0.997			
11—20%	258/819 (31.5)	1.01	0.66—0.71	0.706			
>20%	365/819 (44.6)	0.94					
12. Mortality rate among infected patients					—	—	
0—2%	160/799 (20.0)	1	0.73—1.56	0.748			
3—5%	316/799 (38.6)	1.06	0.86—1.84	0.235			
>5%	323/799 (40.4)	1.26					
13. Extra length of hospital stay for infected patients					—	—	
0—10 days	190/825 (23.0)	1	0.63—1.29	0.568			
11—20 days	346/825 (41.9)	0.90	0.63—1.32	0.623			
>20 days	289/825 (35.0)	0.91					
14. Good hand hygiene effectively prevents infections	838/14 (98.4)	1.89	0.63—5.71	0.255	—	—	
15. Percentage of infections prevented by good hand hygiene					—	—	
0—50%	243/843 (28.8)	1	0.68—1.36	0.828			
51—70%	264/843 (31.3)	0.96	0.78—1.52	0.605			
>70%	336/843 (39.9)	1.09					

Table 3 (*Continued*)

Variable, question item	No. (%) of respondents who reported good adherence	Univariate analysis			Multivariate analysis		
		Odds ratio	95% CI	*p*	Odds ratio	95% CI	*p*
Normative belief							
16. Hand hygiene is a top priority for senior hospital management	599/849 (70.6)	1.23	0.92—1.65	0.171	—	—	
17. Hand hygiene is a top priority for senior nurse management	219/846 (25.9)	0.75	0.55—1.02	0.063	—	—	
18. Colleagues' adherence is good	693/863 (80.3)	2.30	1.62—3.26	**<0.001**	1.79	1.21—2.66	**0.004**
19. Superiors expect adherence	763/846 (90.1)	3.05	1.85—5.03	**<0.001**	2.18	1.23—3.88	**0.008**
20. Colleagues expect adherence	93/855 (10.9)	0.76	0.49—1.17	0.216	—	—	
21. Adherence models are good role models for others	766/849 (90.2)	1.88	1.18—3.00	**0.008**	—	—	
Control belief							
22. Hand hygiene is relatively easy to perform	329/852 (38.6)	1.84	1.39—2.43	**<0.001**	1.84	1.37—2.48	**<0.001**
23a. Not believing effectiveness influence hand hygiene performance	31/866 (3.6)	0.89	0.43—1.83	0.754	—	—	
23b. Overwork influences hand hygiene performance	217/866 (25.1)	1.41	1.04—1.93	**0.028**	—	—	
23c. Difficulties in access to hand hygiene products influence hand hygiene performance	161/866 (18.6)	0.88	0.62—1.23	0.446	—	—	
23d. Low salary influence hand hygiene performance	29/866 (3.3)	0.66	0.31—1.41	0.287	—	—	
23e. Irritation of hand hygiene products influence hand hygiene performance	459/866 (53.0)	0.51	0.70—1.19	0.512	—	—	

[a] Denominators are varying because of difference in number of respondents to the questions.

Table 4 Independent explanatory factors for self-reported good hand hygiene adherence (>80%) in models for three professional categories.

Variable, question item	Physicians		U-nurses		C-nurses		Nurse students		Medical student	
	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI
Demographic characteristic										
7. Receipt of structured training in hand hygiene	—	—	—	—	2.24	1.20—4.16	—	—	3.87	1.26—11.88
10. Hand rub for hand hygiene	—	—	2.19	1.03—4.68	—	—	—	—	—	—
Normative belief										
19. Colleagues' adherence is good	—	—	3.23	1.54—6.78	—	—	—	—	—	—
21. Adherence models are good role models for others	—	—	—	—	3.14	1.25—7.90	—	—	—	—
22. Superiors expect adherence	2.78	1.01—7.73	—	—	—	—	—	—	—	—
Control belief										
23. Hand hygiene is relatively easy to perform	—	—	2.78	1.67—4.63	—	—	—	—	—	—

significant impact on good practices of other HCWs. Furthermore, the expectations of superiors with regard to the HCWs' compliance were an independent explanatory factor for self-reported good hand hygiene. Also, the perception of good adherence by colleagues and role models good practices for others is related with high self reported adherence in the study.

Heavy workload is one of the most important factor that influences the compliance rate of HCWs with hand hygiene. Recent studies clearly show that a low level of nurse staff is strongly associated with an increased infection risk (up to 50% increase), and that accordingly infections could be prevented by increasing nurse staffing [14—18]. Hugonnet et al. [17] estimated that 26.7% of all infections could be avoided if the nurse-to-patient ratio was maintained at a level of >2.2. Overcrowding and understaffing is a main problem of developing countries, including Turkey. Comparing The University of Geneva Hospitals with our University Hospital, the number of beds is 1.7 fold over that of our hospital, whereas the number of admissions is 1.4 lower. Furthermore, the nursing staff level in Geneva is 6.5-fold higher as in Erciyes University [11]. In our institutions the 24-h nurse/patient ratio ranges between 0.5 and 0.7 for the intensive care units, where highly critical patients are cared for, whereas the median nurse-to-patient ratio per 24 h is 1.9 in Geneva [17]. The differences in staffing levels could, in part, explain why hand hygiene compliance rates are at nearly 60% in Geneva [10] whereas they were only 31% in the ICUs of our university hospital (unpublished, observational data) and range between 13% and 34% in other Turkish studies [3,4,19,20]. In their response to the questionnaire, 73% of HCWs reported that heavy workload negatively influences their hand hygiene compliance. Personal economic factors, such as their own low salary (approximately EUR 500 per month for nurses and EUR 1000 per month for physicians) was estimated at less important. We have thought that low salary might effect the motivation of nurses and physicians, so they might be more reluctant to hand hygiene.

Still, 3% of the Turkish HCWs considered that low salary effect their hand hygiene compliance

Especially when the workload is high, the ease of access to hand hygiene products effects the compliance of HCWs. In our institution, alcohol-based products are located at bedside in intensive care units. However in other clinic areas, alcohol-based products are only available in nurses' treatment rooms and dressing rooms. Sax et al. [9] showed that the conviction that hand hygiene required relatively little effort was consistently

associated with good adherence. Also, the same authors reported that using pocket-sized hand rub ''bottles'' increased adherence with hand hygiene compliance [21]. Consequently, 65% of their HCWs' believed that hand hygiene is relatively easy to perform, whereas only 38% of HCWs in our institutions reported easy access to hand hygiene products, since pocket bottles are not available in many developing countries probably due to cost concerns. Still, the perception that hand hygiene is relatively easy to perform is independently associated with a high self-reported adherence rate in our institutions. U-nurses, who believed that hand hygiene is relatively easy to perform, had a 2.8-fold higher self-reported rate of hand hygiene adherence. Furthermore, the use of hand rub for hand hygiene is related with higher rate of self-reported hand hygiene compliance in U-nurses. While our results are supported by the above mentioned literature, we can not rule out that these results, based on self-reports, are a ''post-training conviction'', since most of the HCWs underwent training in which these factors were discussed.

Hand rub is much faster, more effective and allows for high compliance rates [2]. However, only 16% of our HCWs preferred the use of a hand rub over hand washing. The main reason for not switching to hand rubs may lie in the HCWs belief that hand rub products cause skin irritation. More than half of all HCWs believed that their hand-hygiene compliance was negatively affected by the skin irritation assumingly caused by the alcoholic hand rub product. This ''myth'' was highest in U-nurses (64%). Frequent and repeated use of hand hygiene products are an important cause of chronic dermatitis among HCWs, however alcoholic hand rubs cause less skin irritation than soap and water [22,23]. Furthermore, part of the skin irritation caused by hand rubs may be explained by ''incorrect'' usage of the products, such as application on still wet hands, directly following hand washing.

In a recent paper, the influence of religious faith and culture on hand hygiene was discussed [24]. In contrast to other studies [9—11], all of our respondents are Muslim. Unfortunately, we did not ask whether their use of alcoholic rubs was negatively influenced by their religious faith. The prohibition of drinking alcohol in Islam, should not affect its use in healthcare. Moreover cologne, that contains 80% ethyl alcohol, is a tradition treat in our homes in Turkey. Conversely, hand washing is an integral part of Islam and the Turkish culture, as it is deeply embedded before praying, before and after meal, after going to the toilet, etc. This belief can affect the high self-reported adherence, however the observed compliance is still low. It may be rational to use aspects originating from religion faith and cultural values in hand hygiene campaigns.

As in previous studies [9—11], behavioral beliefs did not have effect on self-reported adherence; on the other hand training, strong normative and control beliefs were independently associated with high self-reported adherence in our study.

Conclusion

Improvement of hand hygiene compliance continues to be a priority of hospital infection control programs. However, there are many barriers in countries with limited resources. Despite strong behavioral and normative beliefs, the acceptability of hand hygiene products is limited in our institutions. Accordingly these control beliefs affect the hand hygiene performance of HCWs. The improvement of hand hygiene compliance in developing countries may be achieved by structured training programs, creating good role models and investment in (easy) access to hand hygiene products.

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